14 Stress, Stress Rules, and Syllable Weight

14.1 Introduction

Stress is generally taken to involve the force or intensity with which a syllable is uttered. Stress is also detectable from the many effects it has on segments, since it appears so often in the environment of segmental rules. The influence of stress on segments has been treated already in several locations in this text. The present chapter covers the rules that determine the position of the stress, relating these rules to syllables and to syllable structure.

14.2 Some General Properties of Stress

14.2.1 Culminativity

In most stress languages, every word has exactly one main stress. This observation is sometimes stated by saying that stress is **culminative**; each word "culminates" in one main-stressed syllable. By the principle of culminativity, ['dɔg], ['kæt], and ['hɔɹs] are possible words in English, but a stressless form like *[bə] would not be.

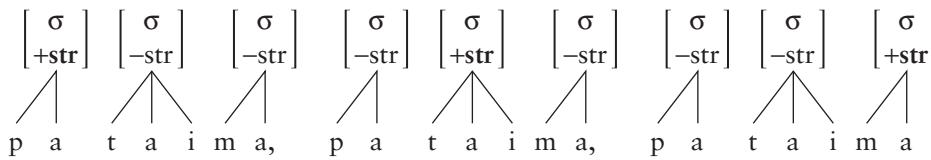
There is one apparent exception to the principle of culminativity: grammatical words, such as articles, pronouns, prepositions, and auxiliary verbs, are often stressless, as in the word *the* in *the book* [ðə 'bʊk]. The evident reason why some grammatical words can be stressless is that they are typically used in the presence of a stressed content word. The grammatical word "leans on" (more formally: is **clitic** to) the content word, and in a sense forms a part of the content word for phonological purposes. When such a grammatical word is used by itself, it receives an artificially imposed stress (['ðʌː] or ['ðiː]), and thus satisfies the principle of culminativity.

14.2.2 No syllable-internal contrasts

Up to now we have treated stress as a property of vowels and other [+syllabic] segments; one speaks of "stressed vowels," "unstressed vowels," and so on. But it is probably more accurate to consider stress as a property of syllables; that is, the units that can be stressed or stressless are syllables, and not segments. Thus when we speak of a "stressed vowel," this can be seen as an informal way of designating the vowel of a stressed syllable.

The reason for saying this is that there are apparently no *contrasts* of stress within the syllable. For example, if we have a syllable containing a diphthong, it is apparently impossible for a language to have a contrast involving stressing the first half vs. the second half of the diphthong. Thus, there are four logically possible ways (assuming culminativity) of stressing a hypothetical word like [pa.ta.ki.ma]: ['pa.ta.ki.ma], [pa.'ta.ki.ma], [pa.ta.'ki.ma], and [pa.ta.ki.'ma]. But there are only three ways of stressing the trisyllable [pa.tai.ma]: ['pa.tai.ma], [pa.'tai.ma], and [pa.tai.'ma]. The stressing [pa.ta'i.ma] is not possible unless there are actually four syllables: [pa.ta.'i.ma].

One way to account for this contrast limitation is to adopt representations in which the feature [stress] is attached to syllables rather than to vowels. In this view, [pa.tai.ma] does indeed have only three possibilities for stress, shown below.



We will see that attaching stress to syllables also offers advantages in formulating stress assignment rules.

14.2.3 Fixed vs. free stress

Stress can be phonemic, by which is meant that it cannot be predicted; there are minimal or near-minimal pairs, as in Spanish ['saβana] 'bedsheet' vs. [sa'βana] 'savanna'. English, Russian, Ilokano, and many other languages have phonemic stress. Stress can also be predictable, as in Polish (penultimate stress; see next section) or French (final stress). One occasionally encounters the terms **free stress**, which means phonemic stress; and **fixed stress**, which means predictable stress.

Even in languages where stress is phonemic, there are almost always tendencies and limitations in stress placement. Spanish observes the limitation that stress must go on one of the last three syllables of the word (the "trisyllabic window"), and shows a strong tendency toward penultimate stress. English likewise has a three-syllable window (violated only rarely in words like '*hesitancy*), and various other limitations discussed in §14.5.3.

14.3 Stress Rules

Where stress is predictable, we can characterize this by deriving it with phonological rules. We will start with a simple case from Polish, where stress is almost entirely predictable. Here are some typical data, illustrating the penultimate stress pattern of this language.

[tele'vizor]	'TV'	
[televi'zor-ek]	'little TV'	
[televizo'r-etʃ-ek]	'tiny little TV'	(k → tʃ / ___ e)

The way we write this rule depends on our approach to representing stress phonologically. Under our earlier approach, with the feature [stress] attached to vowels, the rule would be written to count off the vowels from the end of the word, using the notation /C_0/ (p. 154) to skip over the consonants:

Penultimate Stress (vowel-counting version)
V → [+stress] / ___ C_0 V C_0]$_{word}$
Assign stress to the second-to-last vowel in the word.

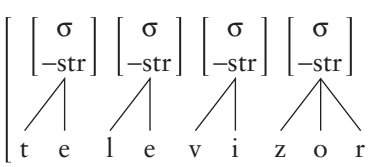
Since vowels and syllables are in one-to-one correspondence, such a rule will have the desired effect.

On the other hand, we just saw that in order to limit possible contrasts, it is appropriate to assign stress to syllables, not to vowels. This idea also permits us to simplify the stress rule somewhat:

Penultimate Stress (syllabic version; preliminary)
σ → [+stress] / ___ σ]$_{word}$
Assign stress to the second to last syllable in the word.

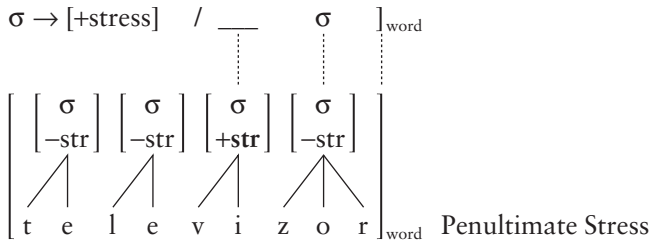
In formulating stress rules, we will assume that syllables always surface as stressless unless they are assigned stress by rule. This will follow if the syllabification algorithm (p. 253) automatically assigns the value [–stress] to syllables when they are created; this can be changed by the later application of the stress rule. Thus the derivation for /televizor/ starts out like this:

[t e l e v i z o r]$_{word}$ underlying form



syllabification, with assignment of [–stress]

The Penultimate Stress Rule is matched up to this form as follows, deriving the correct result:



Penultimate Stress

Consider now some additional facts. Polish has monosyllabic words, which get stressed:

['sen] 'dream'
['stax] 'Stan' (dimin. of *Stanislaw*)

This is not what our stress rule predicts; since these words don't have a penultimate syllable, they don't match up to the rule and thus shouldn't get stressed at all.

Intuitively, what is happening is that since penultimate stress is impossible, the language "settles for" final stress. We will see more complicated examples of this pattern later on – for example, Macedonian aims for antepenultimate stress in words of at least three syllables, and settles for penultimate stress in disyllabic words and final stress in monosyllables.

Within phonological theory, we need to provide a device for characterizing this pattern. Of the various proposals that have been made, we will adopt one that involves a special use of **parenthesis notation**. In this approach, the Polish rule is written as follows:

Polish Stress (final version)
$\sigma \rightarrow$ [+stress] / ___ (σ) $]_{word}$

When a parenthesized rule is written out both including and excluding the parenthesized material, we obtain what are called its **expansions**:

Polish Stress: Expansions
$\sigma \rightarrow$ [+stress] / ___ σ $]_{word}$
$\sigma \rightarrow$ [+stress] / ___ $]_{word}$

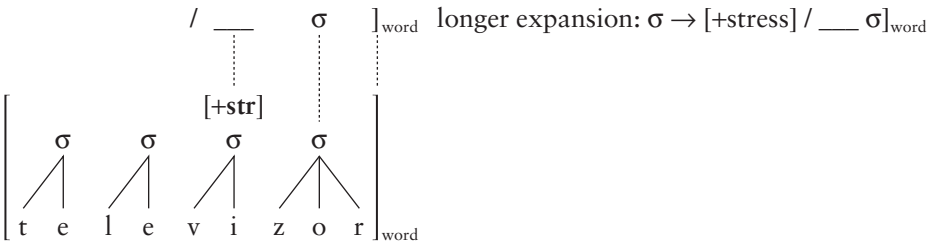
It should be clear that the longer expansion can be used to assign penultimate stress to words with two or more syllables, whereas the shorter expansion will be used to derive stress on monosyllables.

What is needed to complete the analysis is a set of general principles that determine which expansion is applicable to any given form. These are stated below.

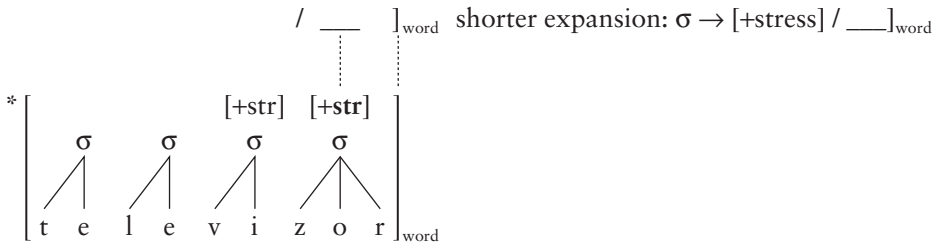
Conventions on Application of Stress Rules Containing Parentheses

a. *Longest first*
   If a stress rule includes an expression in parentheses, the longest expansions must be tried first.
b. *Blockage*
   When a stress rule is applied under some expansion, all remaining expansions are skipped.
c. *Completeness*
   If a stress rule cannot apply in a longer expansion, then the longest available remaining expansion must be tried next.

In the Polish case, the first expansion given above is longest and therefore must be tried first. The representations below leave out the feature [–stress] for the sake of legibility.

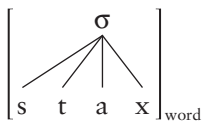


At this point the Blockage provision is crucial – it terminates the application of the stress rule. If Blockage were not in effect, we would go on to derive a second, erroneous stress on polysyllabic words, like this:

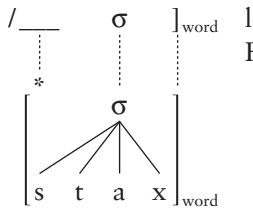


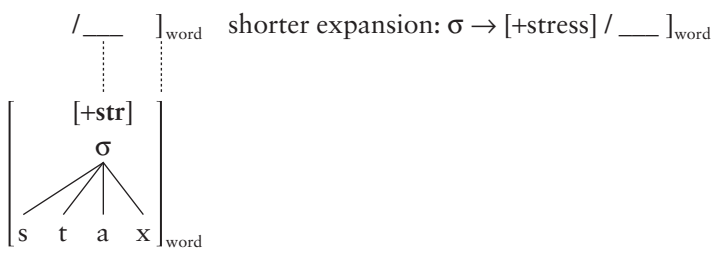
Because of Blockage, this second application doesn't take place, and the correct output is derived.

In a monosyllable like *Stax*, the longer expansion can't apply, so (following the Completeness principle) the shorter version is applicable, giving the right result.



syllabification





14.3.1 Stress rules with multiple parentheses

The conventions on the use of parentheses in stress rules can be applied for multiple parentheses as well. Consider the stress pattern of Macedonian (Slavic, Macedonia), where stress goes three syllables from the end (that is, on the **antepenult**), and on the initial syllable in words shorter than three syllables:

Three syllables and up		**Two syllables**		**One syllable**	
['beseda]	'lecture'	['ʒena]	'woman'	['den]	'day'
[vo'denitʃar]	'miller'	['vide]	'sees'	['rid]	'hill'
[be'sedata]	'the lecture'				
[vode'nitʃari]	'millers'				
[vodeni'tʃarite]	'the millers'				

A possible rule for deriving this pattern is given below.

Macedonian Stress
σ → [+stress] / ___ ((σ) σ)]word

To apply this rule to a form, it is necessary first to determine its expansions. The longest expansion is σ → [+stress] / ___ σ σ]word, with nothing omitted. Leaving out the inner set of parentheses yields σ → [+stress] / ___ σ]word, and leaving out the outer set yields σ → [+stress] / ___]word. If these are applied following the conventions to words of length three (or more), two, and one, the appropriate expansion will assign stress correctly; this is given as exercise 1 below.

A detail of the Macedonian analysis is that within limits, it does not matter where the parentheses are placed. Two other versions of the rule that would work just as well would be σ → [+stress] / ___ (σ) (σ)]word and σ → [+stress] / ___ (σ (σ))]word. They work identically because they have the same expansions.

The general pattern that the theory predicts is that stress often goes a certain distance from a particular word boundary (this can be either the left or the right boundary, depending on the language). The substance of the theory is that if the word is too short for stress to go the maximum distance, it is placed as far from the boundary as possible. Thus, if the theory is correct, we would not expect to find a language that was like Macedonian but placed stress in disyllables on the final syllable instead of the initial. Of the dozen or so languages I'm aware of that place stress up to three syllables from the end, all work like Macedonian in stressing disyllabic words initially.

14.4 Alternating Stress

In many languages stress can fall on several syllables of a word: one primary (strongest) stress and also (in longer words) one or more secondary stresses. Frequently one finds a pattern in which every other syllable is stressed; this is called **alternating stress**. Warao, a language of Venezuela, is an example:

[ˌjapuˌɾukiˌtane'hase]	'verily to climb'	(8 syllables)
[ˌnahoˌɾoaˌhaku'tai]	'the one who ate'	(8 syllables)
[jiˌwara'nae]	'he finished it'	(5 syllables)
[eˌnahoˌɾoaˌhaku'tai]	'the one who caused him to eat'	(9 syllables)

Here, there is penultimate main stress, and a train of alternating secondary stresses going from right to left (orthographically speaking) across the word.

To analyze this pattern, we must first amplify the feature system to accommodate the distinction between primary and secondary stress. This can be done by adding the feature [main]: primary stressed (also called "main stressed") syllables are [+main, +stress], secondary stressed syllables are [–main, +stress], and stressless syllables are [–main, –stress]. Just as with [stress], we will assign the feature [main] to syllable nodes.

Let us first handle the Warao primary stress pattern. In real Warao, there are various complications to the pattern not treated here; for present purposes we will simply write the penultimate stress rule needed for the data at hand; it is essentially the same as the rule in Polish.

Warao Primary Stress

$$\sigma \rightarrow \begin{bmatrix} +\text{main} \\ +\text{stress} \end{bmatrix} / \_\_\_ \ (\sigma) \ ]_{\text{word}}$$

Turning to secondary stress, the task at hand is to write a rule that can in principle lay down an unlimited number of secondary stresses, constrained only by

the length of the word to which it applies. This can be done with **iterative rules**. An iterative rule is assumed to apply to its own output, and it keeps on applying until it can no longer be matched to the input. The basis for iteration normally is that the rule creates new environments for itself; that is, it is **self-feeding** (see §8.4).[1]

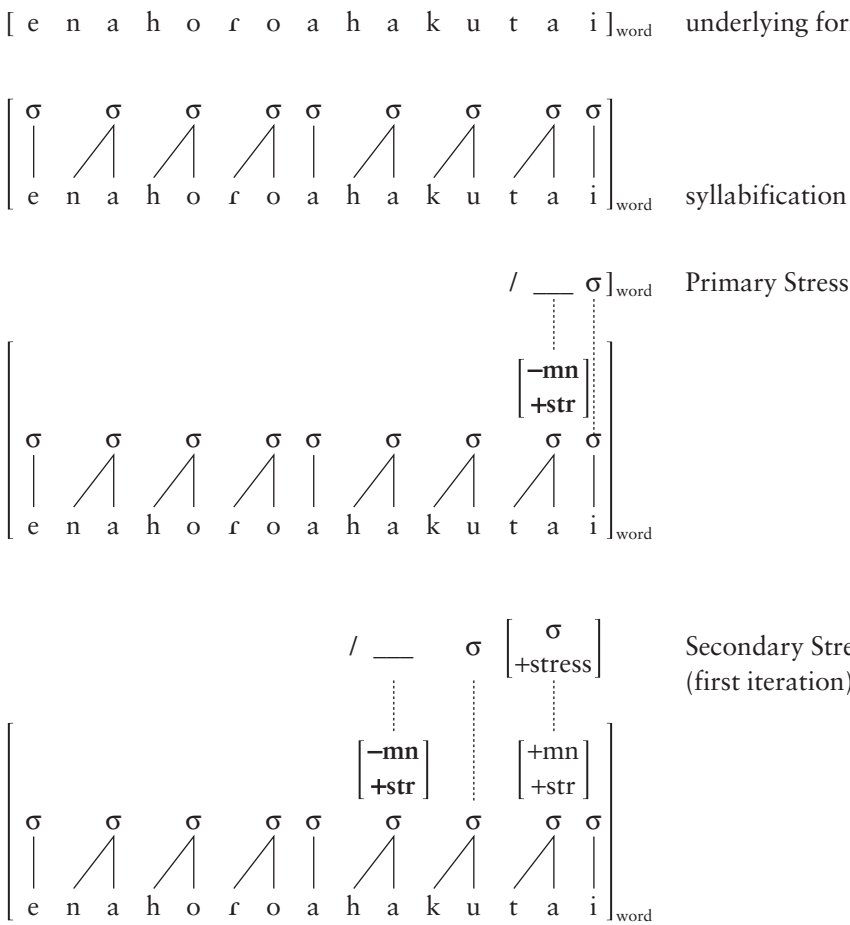
The iterative secondary stress rule for Warao can be stated as follows:

Warao Secondary Stress

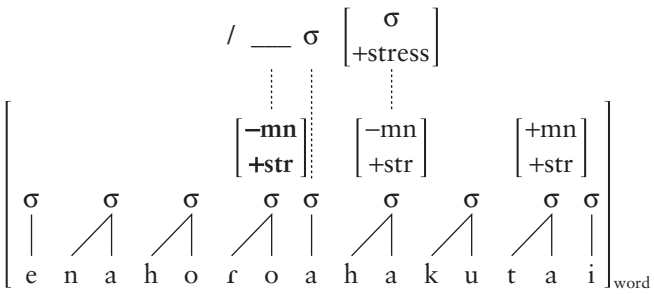
$$\sigma \rightarrow [+\text{stress}] \,/\, \_\_\_\ \sigma \begin{bmatrix} \sigma \\ +\text{stress} \end{bmatrix} \qquad \text{(iterative)}$$

Note that the change specifying [+stress] will create secondary stress, not primary, under the assumption that all syllables start out as [–main].

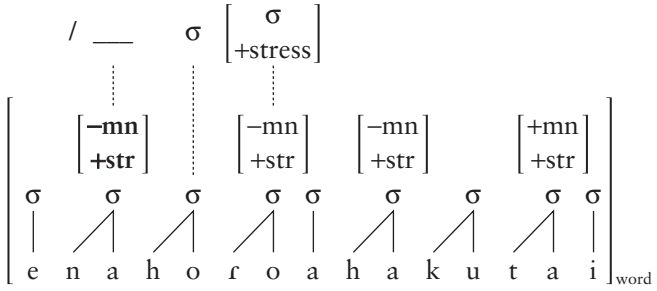
Here is an example of how the rules would work:



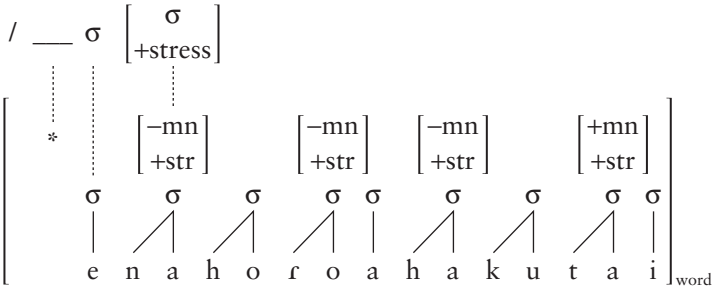
[1] The other possibility is self-bleeding; see Further reading.



Secondary Stress (second iteration)



Secondary Stress (third iteration)



Secondary Stress (fourth iteration, fails)

Here, the Primary Stress rule assigns the penultimate stress, and the Secondary Stress rule then iterates leftward to assign the remaining stresses. It can be seen that Secondary Stress is self-feeding because it assigns the feature value [+stress], which appears in its own environment. At the last attempt to apply Secondary Stress, no stress can be assigned. The Secondary Stress rule has no parenthesized material, and hence does not have a shorter expansion.

Alternating secondary stress is found in many languages, including English, where it is heard in long words such as *ˌreconˌciliˈation*, *ˌonoˌmataˈpoeia*, *ˌirreˌtrievaˈbility*.

14.5 Syllable Weight

In many stress languages, stress is sensitive to a distinction called **syllable weight**. In a simple weight distinction, there are heavy and light syllables, defined as follows:

Heavy syllable: syllable that either
- ends in a consonant or
- has a long vowel or diphthong

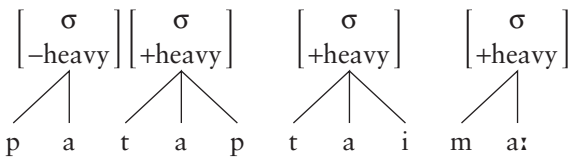
Light syllable: syllable that ends in a short vowel

We will use the symbol /ˉ/, called a **macron**, to denote a heavy syllable, and the symbol /˘/, called a **breve**, to denote a light syllable.

A **closed** syllable is one that ends in a consonant; an **open** syllable one that ends in a short vowel or diphthong. Thus we can restate the definition above: short-voweled open syllables are light, all others are heavy. Other weight distinctions exist, but here we will limit ourselves to languages that use the distinction just given.

Intuitively, heavy syllables are intrinsically more prominent than lights, and in stress systems they tend to be stress-attracting. This is only a tendency, however; as we will see there are cases in which the stress rules of a language will stress a light syllable even when a heavy one is available.

Formally, we must identify just what is meant by /ˉ/ and /˘/. For present purposes, it suffices to assume a feature [+heavy] attached to syllable nodes, and assigned its value by the syllabification rules, using the definition just given. Thus a hypothetical word /pa.tap.ta͡i.maː/ would be represented as follows.



The symbols /ˉ/ and /˘/, when they appear in rules, can thus be interpreted as [+heavy] and [–heavy].

14.5.1 Quantitative meter

The linguistic relevance of heavy vs. light syllables can be shown independently of their role in stress rules. The phenomenon at hand is **meter**, which can be defined as the use of phonological material to embody conventionalized rhythmic patterns in poetry. Meter in English and many other languages is based on stress. However, this is not the only possible kind of meter: in other languages, the basis of meter is an arrangement of the syllables of a line according to their weight.

An example is given below from classical Persian verse (*Golestan*; Sa'di, *c.*1250). First, I give just the transcription and its stress pattern.

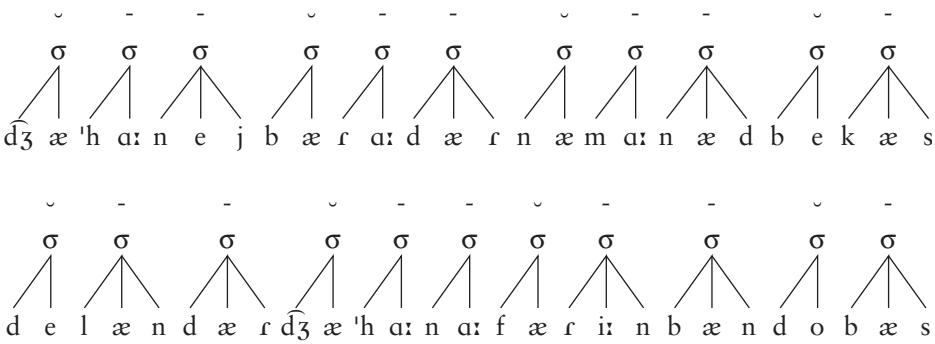
d͡ʒæ'hɑːn,	'ej	'bæɾɑːdæɾ,	'næmɑːnæd	be	'kæs
world	O	brother	waits	for	no one

"The world, O brother, waits for no one,"

'del	ændæɾ	d͡ʒæ'hɑːn	ɑːfæ'ɾiːn	'bænd	o	'bæs
heart	to	world-	creator	tie	and	enough

"Set thy heart on the creator of the world and it is enough."

The stress patterns of these lines are not rhythmic in any way (σ 'σ 'σ 'σ σ σ 'σ σ σ σ 'σ / 'σ σ σ σ 'σ σ σ 'σ 'σ σ 'σ), and could not be the basis of the meter. However, if we syllabify these utterances and classify them into heavies and lights, a clear pattern emerges.



The pattern common to these lines (and indeed to all the thousands of lines of Persian verse written in this meter, called *motaqareb*) is as follows:

˘ - - ˘ - - ˘ - - ˘ -

Clearly, this is a rhythm, consisting of the periodic sequence ˘ - -, truncated to just ˘ - in its fourth appearance.

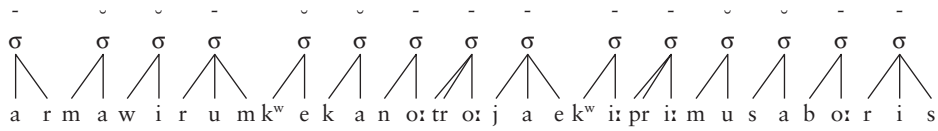
It can be noted that to get the weights right, we must assume that classical Persian resembled Spanish (§13.5) in allowing syllabification to cross word boundaries freely. Were this not so, the word [del] in the second line would retain its coda and wrongly count as heavy. This principle of syllabification holds fairly generally in the corpus of Persian verse.

Meter that makes use of heavy vs. light syllable is called **quantitative meter** ("quantity" being a synonym for "weight" in this context). It is found in many languages, both dead and living. The principle of quantity apparently comes naturally and intuitively to speakers of such languages; for example, many speakers of Berber and of Hausa are able to compose quantitative verse as a form of oral improvisation. The quantitative verse best known to Westerners is found in Greek and Latin. The following example is the first line of Virgil's *Aeneid* (1st century BCE) written in Classical Latin.[2]

ˈarma	wiˈrumkʷe	ˈkanoː	ˈtroːja͡e	kʷiː	ˈpriːmus	ab	ˈoːris
of-arms	man-and	I-sing	from-Troy	who	first	from	place

"I sing of arms and the man, who first from the place of Troy . . ."

[2] Original spelling *arma uirumque cano Troiae qui primus ab oris*. For how scholars make informed inferences about Latin phonemes and syllables, see the reference by W. S. Allen in Further reading.



Here, the rhythm becomes obvious only when one generalizes over many lines to determine the free variation allowed. The full version of the pattern turns out to be the following repeating sequence:

$$- \left\{ \begin{smallmatrix} \breve{} \breve{} \\ - \end{smallmatrix} \right\} - \left\{ \begin{smallmatrix} \breve{} \breve{} \\ - \end{smallmatrix} \right\} - \left\{ \begin{smallmatrix} \breve{} \breve{} \\ - \end{smallmatrix} \right\} - \left\{ \begin{smallmatrix} \breve{} \breve{} \\ - \end{smallmatrix} \right\} - \left\{ \begin{smallmatrix} \breve{} \breve{} \\ - \end{smallmatrix} \right\} - -$$

This pattern is called **dactylic hexameter**. It consists of six units ("feet"), usually taking the form $- \left\{ \begin{smallmatrix} \breve{} \breve{} \\ - \end{smallmatrix} \right\}$. Feet of this type (maximally trisyllabic, with the long element first) are traditionally called "dactyls." It can be seen that the dactyls permit free variation in how they are realized: instead of two lights, a single heavy may be used instead, and this substitution is obligatory for the last dactyl in the line.

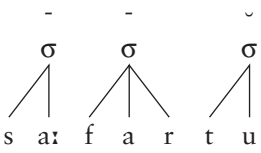
Summing up, quantitative meter forms an argument for the psychological reality of syllable weight. In languages that have a clear quantity distinction, speakers find it natural to arrange the heavies and lights in rhythmic patterns when they create poetry and song.

14.5.2 Stress based on syllable weight

Let us now consider how the heavy vs. light distinction plays a role in stress assignment. The following data illustrate the stress pattern of Classical Arabic as it is rendered by speakers in Palestine and Lebanon:

	Antepenultimate			**Penultimate**			**Final**	
a.	['kassarat]	'she smashed'	n.	[ka'sartu]	'I broke'	u.	['lan]	'not'
b.	[kas'sartuhu]	'I smashed it'	o.	[saː'fartu]	'I traveled'			
c.	[ka'sartuhu]	'I broke it'	p.	[kassa'ruːhu]	'they smashed it'			
d.	['kaːtibun]	'a writer'	q.	[kasar'naːhu]	'we broke it'			
e.	['saːfara]	'he traveled'	r.	[kaːti'biːna]	'writers'			
f.	[mali'katuhu]	'his queen'	s.	['qabla]	'before'			
g.	[ma'likatun]	'a queen'	t.	['faqatˤ]	'only'			
h.	[mak'tabatun]	'a library'						
i.	[makta'batuhu]	'his library'						
j.	[taf'tatiħu]	'he opens ceremoniously'						
k.	[tastaq'biluhu]	'he receives him (as guest)'						
l.	[d͡ʒaː'warahu]	'it bordered it'						
m.	[jud͡ʒaː'wiruhu]	'it borders it'						

In reducing this pattern to rule, the first step is to syllabify and retranscribe as sequences of syllable weight. The one aspect of Classical Arabic syllabification one needs to know is that VCCV is always divided as VC.CV, even for sequences like /abla/ where V.CCV is a plausible candidate. Thus, for example, (o) [saːˈfartu] is syllabified and weighted thus:



and would appear in a data list as ¯ ˈ˘ ˘. Reduced to weight sequences in this way, and right-justified, the data look like this:

	Antepenultimate			Penultimate		Final
a.	ˈ˘ ˘ ˘	h.	¯ ˈ˘ ˘ ¯	n.	˘ ˈ˘ ˘	u. ˈ˘
b.	¯ ˈ˘ ˘ ˘	i.	¯ ˘ ˈ˘ ˘ ˘	o.	¯ ˈ˘ ˘	
c.	˘ ˈ˘ ˘ ˘	j.	¯ ˈ˘ ˘ ˘	p.	¯ ˘ ˈ˘ ˘	
d.	ˈ˘ ˘ ¯	k.	¯ ¯ ˈ˘ ˘ ˘	q.	˘ ¯ ˈ˘ ˘	
e.	ˈ˘ ˘ ˘	l.	¯ ˈ˘ ˘ ˘	r.	¯ ˘ ˈ˘ ˘	
f.	˘ ˘ ˈ˘ ˘ ˘	m.	˘ ¯ ˈ˘ ˘ ˘	s.	ˈ˘ ˘	
g.	˘ ˈ˘ ˘ ¯			t.	ˈ˘ ¯	

In this format, the crucial generalizations become easy to spot: if the *penult* is light, then (assuming enough syllables are present), the *antepenult* gets the stress, as in examples (a)–(m). If the penult is heavy (examples (n)–(s)), or there are only two syllables (examples (s)–(t)), then the penult gets stressed, and in the remaining case (monosyllables like (u)), the final syllable is stressed.

In searching for rule that can assign these stresses, a useful way to start is to state its longest expansion, given below:

Classical Arabic Stress: longest expansion

$\sigma \rightarrow$ [+stress] / ___ ˘ σ]$_{word}$ (for (a)–(m))

This will skip one syllable at the end of a word, and also a light penult, covering the items of (a)–(m) above.

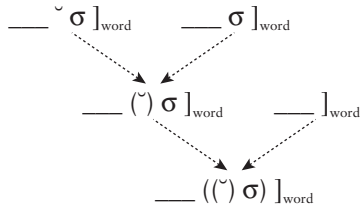
The two shorter expansions must assign penultimate stress and final stress; we have already seen rules of this sort for Polish and Warao.

Classical Arabic Stress: shorter expansions

$\sigma \rightarrow$ [+stress] / ___ σ]$_{word}$ (for (n)–(t))

$\sigma \rightarrow$ [+stress] / ___]$_{word}$ (for (u))

Once we have all three expansions, we can collapse them together into a single rule covering all three cases, as follows:



Thus the final form of the rule is as follows.

Classical Arabic Stress
$\sigma \rightarrow$ [+stress] / ___ ((˘) σ)]$_{word}$

The Classical Arabic case illustrates a general principle involving syllable weight: heavy syllables tend to attract stress, even though they are not invariably stressed. Thus, heavy penults always attract stress, but in a word like (j) [taf'tatiħu] (¯ ˈ˘ ˘ ˘), the initial heavy syllable cannot be stressed. The stress rule specifies a three-syllable window within which stress must fall, and the requirements of this window override the tendency to stress heavy syllables.

The Classical Arabic rule also illustrates the simplification in stress rules we can obtain by using syllable weights. Stated in segments, the same rule would be:

Classical Arabic Stress (segmental version)

$$[+\text{syllabic}] \rightarrow [+\text{stress}] \,/\, \_\_\_\ C_0\ ((\ \begin{bmatrix} +\text{syllabic} \\ -\text{long} \end{bmatrix} C\ )\ V\ C_0\ )\ ]_{word}$$

And it is this simple only because Classical Arabic has a very simple syllable structure. As we will see, in a language that has the same rule, but divides VCCV as VC.CV or V.CCV according to the consonants included, the statement of the rule becomes far more complex.

The Classical Arabic rule is a surprisingly common stress rule among the languages of the world. In various forms it is found in Latin and some modern Romance languages, Klamath (Penutian, Oregon), the historical ancestor of Chimwiini (chapter),[3] and various modern Arabic dialects.

[3] Specifically, it appears that at one time Chimwiini stressed its words as in Latin, then shortened all stressless vowels. Later, the language adopted a new stress system (see ch. 11, Further reading). The rules of Phrase-Final Shortening, Pre-Long Shortening, and Preantepenultimate Shortening are historical restructurings (§11.7), the residue of this history.

14.5.3 Main stress in English

In fact, it appears that the rule $\sigma \rightarrow$ [+stress] / ___ ((˘) σ)]$_{word}$ has seeped into English, probably as a result of the massive influx of Latin loan words. The rule also works when applied to the native words, because the native words are so short (one or two syllables). We see this below.

Where the penult is a light syllable, we normally get antepenultimate stress in words of at least three syllables:

'*reg**i**ment*, '*C**a**nada*, *A*'*mer**i**ca*, '*acc**i**dent*, *Los* '*Ang**e**les*, '*an**i**mal*, '*cap**i**tal*
[d͡ʒə] [nə] [ɪɪ] [sɪ] [d͡ʒə] [nɪ] [pɪ]

Where the penult is closed, and thus is heavy, it attracts the stress:

ap'***pen**dix*, ˌ*dia*'***lec**tal*, *Co*'***lum**bus*, ˌ*conso*'***nan**tal*, *e*'***jec**tive*, *sus*'***pen**sion*
[pɛn] [lɛk] [lʌm] [næn] [d͡ʒɛk] [pɛn]

Likewise when the penult has a long vowel or diphthong, and is therefore heavy, it attracts the stress:

ˌ*Okla*'***ho**ma*, ˌ*Argen*'***ti**na*, *as*ˌ*simi*'***la**tion*, *op*'***po**nent*, *Al*'***too**na*
[hoʊ̯] [tiː] [leɪ̯] [poʊ̯] [tuː]

Disyllables are ordinarily initially stressed, and monosyllables are stressed:

'*vivid*, '*tennis*, '*ketchup*, '*onion*, '*pickle*, '*bubble*, '*proton*, '*concept*
'*bat*, '*sack*, '*moat*, '*spot*

The rule appears to be somewhat productive, in the sense of chapter 9. For example, a hypothetical word like *palacta* seems to allow only penultimate stress. This is what the rule predicts, since the penult /læk/ is heavy. There are also a few cases where words have been diachronically regularized, receiving new stressings compatible with the rule. For instance, the final stress in the normative pronunciations of *po*'*lice* and *gui*'*tar* date from when these words were borrowed from other languages. Both words are, in certain English dialects, pronounced with a regularized initial stress. *Lemonade* and *cigarette* are likewise often regularized to antepenultimate stress.

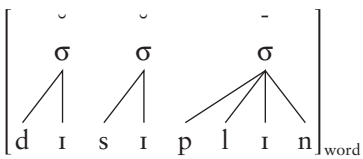
Despite this productivity, there are a great number of exceptions. *Savanna*, *Alabama*, and *abscissa* all have light penults ([væ], [bæ], [sɪ]) but have penultimate, not antepenultimate stress. *Galaxy* is unusual for having antepenultimate stress when the penult is heavy [lək]; *impotent* is a similar case if we assume that *potent* justifies an underlying long [oʊ̯]. As noted earlier (§12.4), abstract analyses have been proposed as an appropriate treatment for these exceptional words.

14.5.4 English stress and the argument for syllables

Words like the following are of interest for the theory of stress and syllabification. Each row is labeled with the consonant cluster that is found between the penultimate and final vowel.

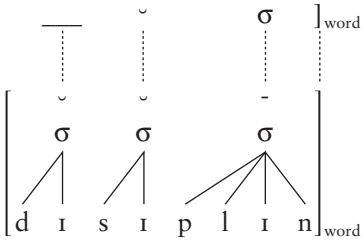
/pl/ *discipline* ['dɪsɪplɪn], *panoply* ['pænəpli]
/bɹ/ *algebra* ['ældʒəbɹə], *vertebrate* ['vɚtəbɹət]
/tɹ/ *idolatry* [aɪ'dɑlətɹi], *symmetry* ['sɪmətɹi], *recalcitrant* [ɹi'kælsətɹənt]
/kɹ/ *ludicrous* ['ludəkɹəs]
/gɹ/ *peregrine* ['pɛɹəgɹən], *integral* ['ɪntəgɹəl]
/kw/ *eloquent* ['ɛləkwənt]
/st/ *travesty* ['tɹævəsti], *amnesty*, ['æmnəsti], *pedestal* ['pɛdəstəl], *minister* ['mɪnɪstɚ]
/stɹ/ *industry* ['ɪndəstɹi], *chemistry* ['kɛməstɹi], *orchestra* ['ɔɹkəstɹə], *tapestry* ['tæpəstɹi]

The system set up in this chapter stresses these words correctly, as follows. First, maximal-onset syllabification creates a final syllable beginning with a cluster (thus, $[dɪ]_σ[sɪ]_σ[\mathbf{pl}ɪn]_σ$ for *discipline*). The conventions for weight assignment classify these syllables as shown.



syllabification

The longest expansion of the English stress rule σ → [+stress] / ___ ((˘) σ)]$_{word}$ then correctly assigns antepenultimate stress to such configurations:



English Stress Rule

Similar results will be obtained for the other words.

The principles of syllabification clearly play an important role here. If we attempted to express the English stress rule without syllables, the result would be quite complex, something like the following:

English Stress Rule (segmental version)

$$V \rightarrow [+\text{stress}] \,/\, \_\_\_\ C_0\ ((\begin{bmatrix}+\text{syllabic}\\-\text{long}\end{bmatrix}\begin{Bmatrix}[-\text{sonorant}]\begin{bmatrix}+\text{sonorant}\\+\text{continuant}\end{bmatrix}\\ s\begin{bmatrix}-\text{del rel}\\-\text{voice}\end{bmatrix}(ɹ)\\ (C)\end{Bmatrix})\ V\ C_0\ )]_{\text{word}}$$

The rule is obviously quite complex. But the main argument is that it misses a crucial generalization: the expression in { } is in fact an outline description of the class of English syllable onsets, which the phonology should characterize in any event. The syllabic rule $\sigma \rightarrow [+\text{stress}] \,/\, \_\_\_\ ((\breve{})\ \sigma)\ ]_{\text{word}}$ is simpler because it relies on independently needed syllabification principles.

Exercises

1 Macedonian stress

Examine the Macedonian stress rule and data in §14.3.1 above, and provide derivations in the format of the Polish derivations on p. 275 for the following words: [vo'denitʃar], ['vide], and ['rid].

2 Simple stress rules

Using the parenthesis formalism of this chapter, write a rule to place stress:

a. on the second syllable of a word, with initial stress in monosyllables
b. on the third syllable of a word with at least three syllables, on the final of disyllables and monosyllables
c. on the middle syllable of an odd-syllabled word, and on the syllable just following the midpoint of an even-syllabled word.

One of the above is a trick question, and has no answer. Explain why not.

3 Alternating stress in Pintupi

Pintupi is an aboriginal language of Australia. Provide rules in the format of this chapter to derive the correct stress patterns for these words. Give derivations similar to those in §14.4 above for examples (d) and (e).

a.	['paɳa]	'earth'
b.	['tʲuʈaja]	'many'
c.	['maɭaˌwana]	'through from behind'
d.	['puɭiŋˌkalatʲu]	'we (sat) on the hill'
e.	['tʲamuˌlimpaˌtʲuŋku]	'our relation'
f.	['ʈiɭiˌriŋuˌlampatʲu]	'the fire for our benefit flared up'
g.	['kuraˌnʲuluˌlimpaˌtʲuɻa]	'the first one (who is) our relation'
h.	['jumaˌɻiŋkaˌmaraˌtʲuɻaka]	'because of mother-in-law'

4 Alternating stress in Polish

At least for some speakers and speaking styles, Polish has alternating stress, with considerable free variation.

a. Provide rules in the format of this chapter to derive the correct stress patterns for the words below.
b. Give derivations similar to those in §14.4 above for words of 1, 2, 4, 5, and 8 syllables.
c. What does your analysis predict to be possible for nine-syllable words?

Hint: for free variation, consult §3.5.

Syls.	**Word**	**Gloss**
1	['sen]	'dream'
2	['flaga]	'flag'
3	[sa'moxut]	'car'
4	[ˌtele'vizoɾ]	'television set-nom. sg.'
5	[ˌakompa'ɲatoɾ]	'accompanist-nom. sg.'
6	[ˌteleˌvizo'ɾet͡ʃek]	'tiny little TV'
	OR [ˌtelevizo'ɾet͡ʃek]	
7	[ˌakomˌpaɲato'ɾovʲe]	'accompanist-nom. plur.'
	OR [ˌakompaˌɲato'ɾovʲe]	
	OR [ˌakompaɲato'ɾovʲe]	
8	[ˌakomˌpaɲaˌtoɾet͡ʃ'kovʲe]	'little accompanist-gen. sg.'
	OR [ˌakompaɲatoɾet͡ʃ'kovʲe]	
10	[ˌkosmoˌpoliˌtaɲt͡ʃɨˌkovʲa'net͡ʃka]	'little, little, little cosmopolitan girl'
	OR [ˌkosmopolitaɲt͡ʃɨkovʲa'net͡ʃka]	

5 Syllable weight

a. Divide the following two lines of classical Persian poetry into syllables (disrespecting word boundaries; see p. 281), and classify each syllable by weight.

d͡ʒæhãː	begæʃtæm	o	dæɾdaː	be	hiːt͡ʃə	ʃæhɾ	o	diaːɾ
world	I traveled	and	pain-voc.	in	no	town	and	region

næjaːfətæm	ke	foruːʃændə	bæxtə	dæɾ	baːzaːɾ
neg.-find-past-1 sg.	that	sell-3 pl. past	luck	in	bazaar

'I traveled the world and, alas! in no town or region did I find that they sold luck in the bazaar.'

b. Even though it looks like there are two slightly different meters, there really is just one. Provide a reasonable guess for why this is so.

6 *Classical Arabic stress*

Apply the Classical Arabic stress rule (p. 284) to forms (c), (n), (s), and (u) on p. 282. For a possible format to use in your derivations, see p. 275.

7 *Stress in Sierra Miwok*

Stress in Sierra Miwok, a native language of California, is predictable, as the following data show:

1.	['ʔimmuʔoːk]	'from there'	7.	['paːpaʔ]	'grandfather'
2.	[wa'kalmɨʔ]	'at the creek'	8.	['t͡ʃamʃɨʃaːkɨːj]	'him, dying'
3.	['t͡ʃamʃɨʃaːkɨːj]	'him, dying'	9.	[wa'kaːlɨʔ]	'creek'
4.	[ʔɨ'wɨːʃaːk]	'he was eating'	10.	[pu'lissaʔ]	'drinking basket'
5.	['weːlɨjjiʔ]	'he goes to get'	11.	['leppanaː]	'he finished'
6.	['loːt̪uːt̪aːnɨt̪iː]	'we two try to catch'			

a. Figure out the generalization concerning where stress falls in Sierra Miwok, and write a rule to derive stress. Your rule should use parenthesis notation and make use of heavy and light syllables.

b. Give derivations (including syllabification, weights, and rule application) for three words, choosing them to illustrate a maximal variety of types.

c. What kind of syllable (defined in terms of stress and weight) is missing from the data?

8 *English syllabification and stress*

a. Syllabify the following underlying representation of English using the rules on p. 253: /kɛɹæktəɹ/ (*character*).

b. Apply the English stress rule $\sigma \rightarrow$ [+stress] / ___ ((˘) σ) $]_{word}$. For a possible format to use in your derivation, see p. 275.

c. Use the result as the basis for an explanation of why second-language English speakers are occasionally heard to say [kə'rækt$^{\text{ɚ}}$].

Further reading

English stress: Chomsky and Halle's *The Sound Pattern of English* (1968, Harper and Row) contains the analysis from which most subsequent work has proceeded. One of the theoretical proposals made there is the set of conventions on parenthesis notation described in this chapter. The analysis is also cited for illustrating the difficulties attendant on analyzing stress without the use of syllable structure.

Mark Liberman and Alan Prince (1977) "On stress and linguistic rhythm," *Linguistic Inquiry* 8: 249–336 pioneered the so-called "metrical" approach to stress, which has been very influential. *Metrical Stress Theory* by Bruce Hayes (1995, University of Chicago Press) analyzes a large number of languages in the metrical approach; it also covers the typology of syllable weight. It should be noted that the approach taken in this chapter, which uses syllables but not metrical theory, is a pedagogically intended mixture. Most work on stress that has used syllables has also used metrical theory.

Iterative rule application is covered in chapter 5 of Michael Kenstowicz and Charles Kisseberth, *Topics in Phonological Theory* (1977, Academic Press). They include self-bleeding as well as self-feeding rules.

Berber quantitative verse: see the reference by Dell and Elmedlaoui cited in Chapter 4. Classical Arabic stress: Michael Brame (1971) "Stress in Arabic and generative phonology," *Foundations of Language* 7: 556–91. Macedonian stress: Steven Franks (1989) "The monosyllabic head effect," *Natural Language and Linguistic Theory* 7: 551–63. Hausa quantitative verse: Russell G. Schuh, "Text and performance in Hausa metrics," downloadable from www.linguistics.ucla.edu/people/schuh/Metrics/Papers/anti_mutadarik.pdf. Latin syllable weight and meter: W. S. Allen, *Accent and Rhythm* (1974, Cambridge University Press). Persian meter: Lawrence Paul Elwell-Sutton, *The Persian Meters* (1976, Routledge). Warao stress: Henry Osborn (1966) "Warao I: Phonology and morphophonemics," *International Journal. of American Linguistics* 32: 108–23.